

DRAWINGS ATTACHED.

956,564



Date of Application and filing Complete Specification :  
June 3, 1960. No. 19837/60.

Application made in Switzerland (No. 73943) on June 3, 1959.

Complete Specification Published : April 29, 1964.

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Index at Acceptance :—B2 B(2H, 4B, 4C, 4X); B2 E(1A, 1H); D1 L23X.

International Classification :—B 05 (D 06 b, m).

#### COMPLETE SPECIFICATION.

#### The Production of Coatings of Synthetic Resin by Electrostatic Spraying.

We, POLYCHEM A.G., a Body Corporate organised and existing under the laws of Liechtenstein, of Vaduz, Liechtenstein, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 The present invention relates to a method for producing surface coatings of synthetic resins by electrostatic spraying, which coatings may be utilised as modifying coatings on the substrate on which they are formed or, when stripped from the substrate, as self-supporting films.

15 The production of coatings of synthetic resins has hitherto been effected mainly by casting, rolling, die casting and spreading. All these known methods have several drawbacks, and lead to a relatively great layer thickness and, moreover, do not result in an absolutely uniform coating. They may also influence the structure of the coating material by mechanical deformation. As most of the synthetic resins are materials which are rather viscous in the plastic or molten state, it has hitherto seemed impossible to produce therefrom very thin coatings having a thickness of only a few molecular diameters, and although it was believed to be absolutely necessary that the distribution of the plastified material for the formation of the coating should be effected mechanically, experience has shown that the fineness of distribution necessary to obtain thin, uniform coatings cannot be achieved mechanically.

20 25 30 35 40 The technique of electrostatic spraying has been applied in the production of synthetic resin coatings, but it has not hitherto

been possible to produce by this technique coatings of outstanding fineness or homogeneity. The difficulty has been especially pronounced in the case of viscous materials such as molten compositions, but inferior results are also obtained with compositions such as lacquers.

45 50 55 60 65 70 75 80 It has now been found that an important consideration is the selection of the correct value of the electrical conductivity of these materials. Tests have shown that not only materials with low conductivity but also materials with a relatively high conductivity give worse results than materials with an intermediate conductivity. For example, it has been ascertained that the conductivity of a water mist is too high while the conductivity of paraffin hydrocarbons is insufficient. The reason for this may be that on the one hand the bad charge carriers are less accelerated by the field, and thus also do not tend to rupture and further reduction in size during transport by the field while on the other hand the good charge carriers lead to a breakdown of the field and thus render impossible the production of the acceleration necessary for the disruption of the particles. These drawbacks of some of the resins particularly desirable for the production of thin coatings may be prevented by modifying their electrical conductivity or resistivity by certain additions, namely of small quantities of polar organic compounds which have a pronounced effect on the electrical conductivity in such a manner that their conductivities come into the range which is the best for perfect atomization. When mixing such materials care must of course be taken that the components do not have unfavourable influences

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on each other and more particularly that they are chemically compatible.

In accordance with the present invention there is provided a method of producing 5 coatings of synthetic resins in which a composition of the resin is exposed to an electrostatic high tension field by means of which particles of the composition are separated and are transported to and deposited on a receiving surface, a small quantity of at least one compatible polar organic compound being incorporated in the composition to increase the electrical conductivity thereof.

10 Thereby it has proved possible for the first time to produce extremely thin foils, coatings and the like of a high degree of uniformity from thermoplastic and thermosetting synthetic resins. Not only is it possible for the first time to obtain fine 15 coatings of resins in a plastic or molten condition, but compositions such as lacquers which were sprayable by known electrostatic procedures now give coatings 20 of improved quality.

25 The quantity of polar organic compound incorporated is preferably from 0.1% to 10% by weight, as shown in the examples hereinafter.

30 The invention is particularly useful for producing coatings of synthetic resins as melts or powders, or synthetic resin compositions such as plastisols; these materials are themselves non-conducting, and 35 usually require a reduction of their resistivity to obtain the desired or optimum value for spraying.

40 The preferred polar compounds, as used in the examples, are salts, esters and amides of organic acids having a relatively long aliphatic chain in their molecules. The hydrocarbon chain in these compounds ensures compatibility with non-polar resin and solvent systems, while the 45 acid grouping is responsible for their strong influence on the electrical conductivity of the composition.

50 Other features and advantages of the invention will become apparent from the description now to follow, in which the method of the invention will be explained in more detail with reference to the accompanying drawings showing diagrammatically several embodiments of apparatus for 55 carrying out such method. In these drawings:—

60 Figure 1 illustrates a first embodiment of apparatus for producing strip or band-shaped coatings; and

65 Figure 2 shows a second embodiment of apparatus for producing strip or band-shaped coating.

Referring to Figure 1 of the drawings, a machine frame housing 1 is provided with wind-up and wind-off reels 2 for a

carrier band or strip 3, for example of paper, metal, synthetic material, textile material or the like. An electric motor 4 serves to drive one of the reels 2. The carrier strip 3 leads from the undriven reel 2 over a guide 5, traverses the actual working zone of the apparatus, and reaches the driven reel 2 over a second guide 5. Heating lamps 6 facing the under-side of the carrier strip 3 are arranged in the working zone of the apparatus between the two guides 5. Furthermore, the frame 1 is provided with a carrier for a material container 7, provided with a heating device 8. This container 7 is adjustable in height in a manner not shown. The container 7 is connected by means of a conduit 9 with a slot-nozzle 10 arranged below and spaced from the carrier strip 3. The nozzle 10 is connected with a high-tension device 11.

In the operation of the described apparatus, the resin composition to be worked into a coating structure is brought in the container 7 to the viscosity and conductivity required for a perfect atomization. This may in addition to the heating also be obtained chemically by addition of polar organic compounds according to the invention, by mixing, and by the use of appropriate solvents or plastifying agents. The flowable material, which is brought by an appropriate adjustment in height of the container 7 to a level immediately above the opening of the nozzle 10 acting as an overflow, is drawn up in the form of fine droplets and thrown against the under-side of the carrier strip 3 by the strong electrostatic field produced by tensions of at least 20 kV between the nozzle and the earthed carrier strip. Preferred potentials are 30—60 kV, as then a particularly strong further division of the material particles drawn upwardly by the field is obtained before they impinge on the carrier strip 3 and adhere thereto. In certain cases potentials of 40—75 kV may be most suitable, but with liquids or melts it is not normally desirable to exceed the latter figure. The selection of the optimum potential for each case depends of course also on the distance between the nozzle and the carrier strip. Owing to the fineness of the impinging particles, a highly uniform and homogeneous coating is obtained on the carrier strip 3. By an appropriate metering of the material leaving the nozzle mouth, by an appropriate selection of the nozzle size, and by adjusting the viscosity of the strip, coatings of any desired thickness down to the thinnest coatings having a thickness of only a few molecular diameters may be obtained on the carrier strip.

According to the type of the coating

material the carrier strip must be heated more or less in the zone of impact of the particles. This is effected with the lamps 6, the heating output of which may be made adjustable. The cooling and hardening of the coating usually is automatic as soon as the coated carrier strip has moved out of the heating zone.

As already mentioned, it is possible to use quite different materials for the carrier strip 3, such as for example metal, paper, textile or synthetic materials and the like. Instead of bands or strips, other carriers such as drums or the like provided with a receiving surface could be used. Metallic carriers will be used when the coating structure to be produced is afterwards to be separated from the carrier. Thereby band foils for different purposes may be obtained, suitable for use for example as packing materials, as diaphragms, or as base foils for subsequent coating with other materials. It is also possible to produce the carrier from an electrically insulating material. In this case it is preferable to arrange above the surface of adhesion of the carrier a metallic counterelectrode, for example a band foil 12, as shown in the drawing. In the illustrated embodiment this foil 12 is guided over deflecting cylinders 13 arranged in the frame 1 and adapted to be driven together with the carrier strip. The foil 12 simultaneously serves to hold plane the carrier strip arranged underneath and which tends to take an arc-shaped cross-section whereby the distance separating the edges of the strip from the nozzle acting as electrode may become so small that flash-overs may occur. Such flash-overs and the momentary breakdown of the field resulting therefrom inevitably lead to irregularities of the coating on the carrier. Of course, other means could be provided for keeping plane the carrier strip 3. The metallic counterelectrode shown in the illustrated example could be replaced by an electrode of another conductive material for example by a carbon electrode.

By the use of a counterstrip 12 the present method renders possible also the production of other than continuous structures, for example patterned structures, i.e. of structures provided with cut-outs or other shapes differing from the shape of the carrier strip. If, for example, the counterstrip 12 is formed by a metallic strip which has cut-outs at the places at which the carrier strip 3 is to remain free from coating, a correspondingly patterned coating of the carrier strip 3 will be obtained when the counterstrip is moved synchronously with the carrier strip 3.

Besides very thin coatings, the method

of the invention also permits production of multiple-layer coatings by guiding the carrier strip 3, at intervals of time or continuously, several times past the nozzle 10. Thereby, the subsequent layers may be of the same material or of different materials. Relatively thick structures may thereby be obtained with one and the same method with a desired surface of high quality material and with a base of material of less quality and of lower price. This is particularly advantageous where the base material cannot otherwise be obtained in the desired quality and with the desired thinness. On the other hand several nozzles arranged in series may be used, whereby a multiple-layer coating may be produced in one operation.

The method of the invention may also be used for producing structures from synthetic resins which hitherto were obtained by welding together several layers which after being drawn are not easy to weld. Such a material is for example "Terylene" (Trade Mark). In such a case, according to the described method, a drawn foil is provided according to the method with a second layer and tests have shown that a perfect connection of the two layers is obtained thereby.

The described method may not only be used for the production of plane structures. By appropriate arrangement and construction of the nozzle 10 the method may also be used for coating solid bodies of any desired surface conformation and for providing such bodies with a strongly adhering coating of plastifiable or pulverisable material in such thin layers as was impossible with hitherto known coating methods.

If a powdered resin composition is used as starting material, the powder is brought onto a support serving as an electrode and replacing the nozzle 10. From this support the powder is drawn upwardly towards the carrier strip 3 by the high-tension field. By an appropriate selection of the potential which for an appropriate spacing of the electrodes may exceed 100 kV, e.g. 120 kV, it may be arranged that between the support and the carrier strip a particle size classification of the material particles is effected by the gravity effects counteracting the field effect, whereby only the finest particles reach the carrier strip while the coarser particles fall back onto the support. By such a method homogeneous coatings may be obtained from such small particles as cannot be obtained by mechanical sieving. Of course, when powdery material is used, measures must be taken for melting and obtaining the adherence of the particles impacting on the carrier strip. This par-

ticular process is preferably effected with thermoplastic solids, wherein, for example by means of the heating lamps 6, the carrier strip is brought to the required temperature. Also heatable drums may be used as carriers in such a case.

In the preceding it was assumed that the composition is exposed to an electrostatic field having upwardly directed lines of force. It is however also possible to make the arrangement so that the lines of force of the field extend obliquely or from the side or downwardly to the carrier strip. Thereby gravity may be used for transporting the particles while the electrostatic field mainly serves to reduce the dimension of the particles. This last mentioned effect is improved in many cases with increasing potential so that potentials of more than 60 kV may be applied.

In certain cases it may be advantageous to lead the material to be atomized under a certain pressure to the electrode nozzle or jet. In such a case too the main object of the electrostatic field is the further reduction in size of the particles of the pressure jet previous to their impact on the carrier strip.

When it is desired subsequently to remove the produced coating from the carrier strip the latter should be appropriately prepared or appropriate additions should be mixed with the particle material to obtain less adherence of the coating.

With the described method various synthetic resins may be worked in a most simple manner into covers, layers, protective layers (for example against permeability and tear), ornamental layers (with or without colour additions or patterns) armour coatings (reinforcement of the base, for example in easily tearable packing papers), bands and foils having one or several layers of any desired thinness. The apparatus required for working the method is relatively simple and no mechanical working of the produced coating is required. Potentials may be used within a very large range whereby it is also possible to provide auxiliary electrodes, laterally or at the rear of the carrier for controlling the electric field. Likewise, the same method may be used for producing thin layer bodies from mixtures of liquid and solid particles.

By appropriate construction of the counterelectrode it is also possible to produce porous structures and coatings. Thus, a finely perforated counterelectrode or a counterelectrode having insulating elements distributed on it could be used. In a similar manner it is also possible to continuously or sectionally modify the thick-

ness of the coating on the carrier moving past the nozzle.

Compositions may be exposed to the field in a substantially liquid condition or as a powder, as described in the examples hereinafter. Under favourable conditions, for example when the amount of metal in the vicinity is kept to a minimum, especially at the nozzle, satisfactory spraying of a material can be achieved when the properties of the liquid fall within the following ranges: resistivity from  $0.3 \times 10^6$  to  $5.5 \times 10^{10}$  ohms/cm<sup>3</sup> (measured in the case of a molten resin, such as a polythene melt, at 140° C.) and preferably  $0.3 \times 10^6$  to  $1 \times 10^9$  ohms/cm<sup>3</sup>; dielectric constant exceeding 1.4 and preferably from 1.9 to 2.5; and viscosity in the case of a molten resin not exceeding 2 minutes 15 seconds flow time in a Ford Cup No. 4 viscometer at 400° C., and preferably less than 1 minute 20 seconds. In the case of a plastisol the viscosity preferably does not exceed 3 minutes 10 seconds flow time in a No. 4 Ford Cup, measured at 45° C. The materials having a resistivity of between 0.3 and  $20 \times 10^6$  ohm/cm<sup>3</sup> at 22° C., and especially between 0.3 and  $15 \times 10^6$  ohm/cm<sup>3</sup> are in general easily sprayed by this method. The viscosity of these materials should preferably not exceed 80 poises at 21° C. and preferably is about 50 poises.

It has been found that satisfactory results are obtained where the potential is within the range 15 to 150 kV, and preferably from 20 to 50 kV. The production of coatings from a powdered material usually requires a potential of 60 kV or above.

The apparatus shown in Figure 2 comprises a jacketed container 15 fitted with a stirrer 16. From the container 15 a conduit provided with a control valve 17 leads to a jacketed screw pump 18 which feeds a vertically directed jacketed nozzle 19. Above the nozzle 19 is a counterelectrode in the form of a metal drum 20 provided with internal heating (not shown). A web of carrier material 21 to be coated is removed from a let-off roller 22 and passes round a guide roller 23, round the electrode drum 20, past heating element 24, round a further guide roller 25 and through a cooling station 26 and is taken up by a take-up roller 27. The rate of feed of the pump, the width of the orifice and the distance between the nozzle and the electrode roller are all adjustable, and the temperatures of the container 15, the pump, the nozzle 19, the electrode drum 20 and the heater 24 are all variable at will.

In operation a high potential is applied between the nozzle 19 and the counterelectrode 20, the material and the polar organic compound are introduced into the

5 container 15. The plastified material is passed by the pump 18 to the nozzle 19 where it enters the field and is converted into a spray of fine particles. The particles are conveyed upwards by the field towards the counter-electrode 20 and are simultaneously reduced in size, forming an extremely fine mist of dispersed particles before they strike the underside of the carrier web 20. A uniform coating of extremely fine particles is thereby produced on the carrier web 21 and may be further heated at the heater 24 to ensure complete fusion. The coated web is then 10 cooled in the cooler 26 and wound on the take-up roll 27.

15 The following are some practical examples of methods carried out by this apparatus.

20 EXAMPLE 1.

25 34 kg of refined paraffin wax m.pt. 80° C. was added to 6.5 kg of polyethylene wax (Union Carbide DYDT) and 4.5 kg magnesium stearate. The mixture was heated to 150° C., stirred, and then pumped at a constant rate to the nozzle 19. The viscosity of the melt was 37 poises and the resistivity approximately  $25 \times 10^6$  ohms/cm<sup>3</sup> at 100° C. The counter-electrode was 30 heated to 120° C. and the atmosphere around was heated to 90° C.

35 Bleached, sized paper was passed around the drum as a receiving surface, which was sprayed by applying a field of 60 kV between the nozzle 19 and the drum 20. A uniform coating was obtained, and after passing the web through the heater and cooler, it was wound onto the take-up roller.

40 It has been found that with the hitherto known electrostatic spraying methods grade 20 (British Standard Specification 2782, part I) polythene cannot be atomised to the fine mist required for the formation of a homogeneous coating. With the method of the present invention, however, according to which viscosity and/or conductivity and/or surface tension of the melt to be atomised are modified in such a manner that this melt may be sprayed, it is possible to produce perfect, very thin, homogeneous layers. Moulding grade polythene is of such a viscosity that electrostatic energy alone is insufficient to break up the melt into particles, and the viscosity must be reduced by the use of compatible viscosity depressants coupled with the action of heat. As a low viscosity and relatively high temperatures are required to make such polythene suitable for spraying, it is generally necessary to add an anti-oxidant agent and to carry out the melting in a closed system. Polythene treated in such manner can be lifted by a high potential field, but no fine mist

is obtained, i.e. the droplets formed are too large. In order to diminish the size of the droplets it is also necessary to increase their conductivity, which may be achieved by additives suitable for use at temperatures of around 400° C.

70 The following are the preferred properties for a composition comprising moulding grade polythene: resistivity (measured at 140° C. using a conductivity dip cell type E.7591/A, a potentiometer and an H.T. battery as power source) not greater than  $5.5 \times 10^{10}$  ohms/cm<sup>3</sup>, preferably about  $1 \times 10^9$ ; dielectric constant (measured at 140° C. using Wayne Kerr Bridge B221 and dielectric constant cell D.121) not less than 1.4 and preferably 1.9 to 2.5 (corresponding to capacities of the cell of 0.3, 0.4 and 0.5  $\mu\mu$ F respectively); viscosity (No. 4 Ford Cup at 400° C.) 2 mins. 15 secs. maximum.

75 However, the reduction of the viscosity and the increase of the conductivity generally are still insufficient to obtain the particle size desired and it was found advantageous to reduce the surface tension of the melt which may be obtained by the use of additives acting in the nature of protective colloids. Grade 20 of polythene may in this way be ruptured electrostatically to the finest mist.

80 In practice, the polythene is melted in an extruder and fed to the nozzle at constant pressure. The insulated nozzle is provided with the required high potential 100 for producing the field. The arrangement preferably is such that the nozzle is below the counter-electrode at a distance of about 14 cm. It is recommended to arrange several nozzles in parallel and to 105 guide the carrier band, for example by means of suction rollers, along the different spraying stations.

85 In the case of spraying material of higher viscosity, it has been found to be 110 advantageous to insulate both electrodes with respect to their surroundings and to apply a negative potential to the nozzle electrode and a positive potential to the counter electrode. With such an arrangement improved dispersion of higher viscosity melts or liquids may be obtained, as compared with arrangements in which one electrode is earthed.

90 115 EXAMPLE 2.

120 The favoured formulation using grade 20 Polythene is as follows:—

Alkathene XRM.21	...	...	100
Hydrocarbon wax, softening point 80—90° C. (Swan Wax A.36)	5	125	
Chlorinated diphenyl (Aroclor 5460)	10		
Magnesium Stearate	...	1	
Purified "Butylated Hydroxy Toluene"	...	0.15	
Dilauryl thiodipropionate	...	0.05	
		130	

The words "Alkathene" and "Aroclor" are Trade Marks. "Butylated Hydroxy Toluene" is a commercial cresol derivative of indefinite composition, marketed by 5 William Pearson Limited. The above components, with the exception of Aroclor, are blended together in a two-roll mill. When the composition is nearly gelled, the Aroclor is added and mixing is continued 10 until smooth. The composition is then sheeted off and diced ready for extrusion. After the composition has been checked for melt flow index and electrical conductivity, it is passed through the extruder 15 at a temperature of 390° C. and 400° C. at the nozzle.

The present method may also be used 20 for spraying powders of polymers and synthetic resins. In the conventional methods it was found that conventional polythene powders when lifted from the spraying electrode do not result in uniform coatings. This also happened in the case of 25 PVC powder although slightly better results were obtained owing to the smaller particles size of the material. In order to obtain perfect spraying of polythene or PVC powder, the powder is treated to coat it with a thin partially conductive film. 30 This results in excellent spraying properties of the powder.

A perfect spraying of PVC powder occurred when the conductivity thereof 35 was  $0.2 \times 10^{-4}$  mhos and the dielectric constant at 3.4 (0.66  $\mu\mu F$  in the cell). Without modification the PVC powder had a conductivity of less than  $10^{-5}$  micromhos and a dielectric constant of 2.6 (0.53  $\mu\mu F$  in the cell).

#### 40 EXAMPLE 3.

0.1% of lauric acid monoethanolamide, and 45 0.1% of propylene glycol monostearate was dissolved in 100 parts of methylene chloride. The solution was then added to 100 parts of polythene powder which had previously been wetted with 100 parts of methylene chloride. The whole mixture 50 was stirred until uniform, and the methylene chloride was then stripped off by vacuum distillation. The dried powder was disintegrated to 40 mesh B.S.S. and sprayed from an electrostatic tray at a negatively charged potential of 30 kV at a distance of 14 cm from the counter electrode. 55 Over the counter electrode aluminium foil was passed at a speed of 5 m/min., which was heated to 180° C. to fuse the 60 deposit into a uniform film. After deposition and heating, the coated material was passed over a heated polishing bar and the foil was then cooled and wound up. Similar results were obtained with PVC pow-

der, the latter was treated on the surface 65 with a mixture of 0.05% of sodium dioctylsulphosuccinate and 0.05% of lauric acid monoethanolamide.

Considerable difficulty was experienced 70 in spraying polymeric and resinous pastes by electrostatic means due to the high electrical resistivity of these materials. In particular polyvinyl chloride pastes were investigated. Here a poor dispersion of 75 the mass in the electrostatic field was obtained when the material was sprayed in the conventional manner, using the nozzle described at a 30 kV potential and a spacing of 14 cm between nozzle tip and counter electrode.

Work was then carried out to improve 80 spraying properties so that a commercially usable product could be obtained. It was found that the conductivity of the conventional paste consisting of PVC paste polymer ("Geon 121" (Trade Mark)) 100 parts, diisooctyl phthalate 120 parts was  $0.4 \times 10^{-4}$  85 micromhos and the viscosity was 1 minute 20 seconds at 45° through a Number 4 Ford Cup Viscometer.

#### EXAMPLE 4.

When the above formulation was modified to contain:—

	Parts
Geon 121 PVC Paste Polymer	100
Diisooctyl phthalate	120
Sodium dioctylsulphosuccinate	2
Lauric acid monoethanolamide	2
Magnesium stearate	2

The conductivity of this mixture was 100 measured as  $0.6 \times 10^{-3}$  micromhos and the viscosity at 45° C. was 3 minutes 10 seconds measured by a Number 4 Ford Cup Viscometer.

This modified formulation afforded good 105 electrostatic spraying properties when charged with 30 kV at 14 cm distance from the counter-electrode using the spraying jets described. It was also found that under these conditions the maximum 110 viscosity which should be sprayed was around 3 minutes 10 seconds by a Number 4 Ford Cup Viscometer at 45° C., and the minimum conductivity was  $0.6 \times 10^{-3}$  115 micromhos. The electrical properties described above were measured using a Wayne Kerr Bridge type B.221 and a Capacity Cell type C.121 at 45° C.

In a practical test the modified PVC 120 paste formulation described above was sprayed electrostatically in a finely divided form onto a fabric, and on fusing resulted in a uniform and continuous film.

#### EXAMPLE 5.

Tests have shown that a melt of poly- 125

thene (DYDT Union Carbide) sprays at a temperature of 140° C. in an electrostatic high potential field in large droplets which, after their deposition on the 5 carrier band, have a diameter of between  $\frac{1}{2}$  and 4 mm. It is thus not possible to obtain in this manner a thin homogeneous film. If, however, an additive improving 10 the viscosity and more particularly the conductivity is added to the polythene, for example 16 g. capric acid ethanolamide to 400 g. polythene, the melt sprays at 140° C. in fine droplets having a diameter 15 of 30  $\mu$  or less. In both cases the potentials applied were between 75 and 80 kV.

**EXAMPLE 6.**

A further test shows that a lacquer composed of 90 g. Ketone resin "Synthetic Resin SK" (Chemische Werke Hulst) and 210 g. toluol sprays at room 20 temperature and under a potential of 70 kV in the form of individual jets which are not ruptured or which rupture only to large droplets. If an appropriate additive, 25 for example 10 g. lauric acid isopropanolamide is added, the jets in the field rupture to droplets having a diameter of 30  $\mu$  or less.

It has thus been found that by appropriate additives the sprayability of lacquers, melts, pastes and powders may be improved chemically or physically by corresponding influencing not only of their viscosity and surface tension, but notably 35 of their conductivity to such an extent that the method of the invention permits use of materials for producing thin uniform coatings which heretofore were not considered to be adapted for such use.

**40 WHAT WE CLAIM IS:—**

1. A method of producing coatings of synthetic resins in which a composition of the resin is exposed to an electrostatic high tension field by means of which particles of the composition are separated and are transported to and deposited on a receiving surface, a small quantity of at least one compatible polar organic compound being incorporated in the composition to increase the electrical conductivity thereof.
2. A method according to Claim 1 in which the total quantity of polar organic

compounds incorporated is from 0.1% to 10% by weight of the composition.

3. A method according to Claim 1 or 2 in which the polar organic compound is a salt, ester or amide of an organic acid having a relatively long aliphatic chain in its molecule, or a mixture of such salts, esters or amides.

4. A method according to any of Claims 1 to 3 in which a sufficient quantity of the polar organic compound is incorporated to bring the electrical resistivity of the composition to within the range of from  $0.3 \times 10^6$  to  $5.5 \times 10^{10}$  ohms/cm<sup>3</sup>, the dielectric constant of the composition exceeding 1.4.

5. A method according to any of Claims 1 to 4 in which the composition as exposed to the field is a molten resin the resistivity of which is determined at 140° C., and has a viscosity not exceeding a value corresponding to a flow time of 2 minutes 15 seconds in a Ford Cup No. 4 viscometer at 400° C.

6. A method according to any of Claims 1 to 4 in which the composition exposed to the field is a plastisol having a viscosity not exceeding a value corresponding to a flow time of 3 minutes 10 seconds in a Ford Cup No. 4 viscometer at 45° C.

7. A method according to any of Claims 1 to 4 in which the composition exposed to the field is a powder and the polar organic compound is applied as a coating to the particles of the powder.

8. A method according to any of the preceding claims in which the polar organic compounds employed include magnesium stearate, propylene glycol monostearate, sodium dioctylsulphosuccinate, lauric acid monoethanolamide, lauric acid isopropanolamide or capric acid ethanolamide.

9. A method of producing coatings of synthetic resins substantially as described in any of the examples.

10. Coatings or layers of synthetic resin produced by a method according to any of Claims 1 to 9.

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Fig. 1.

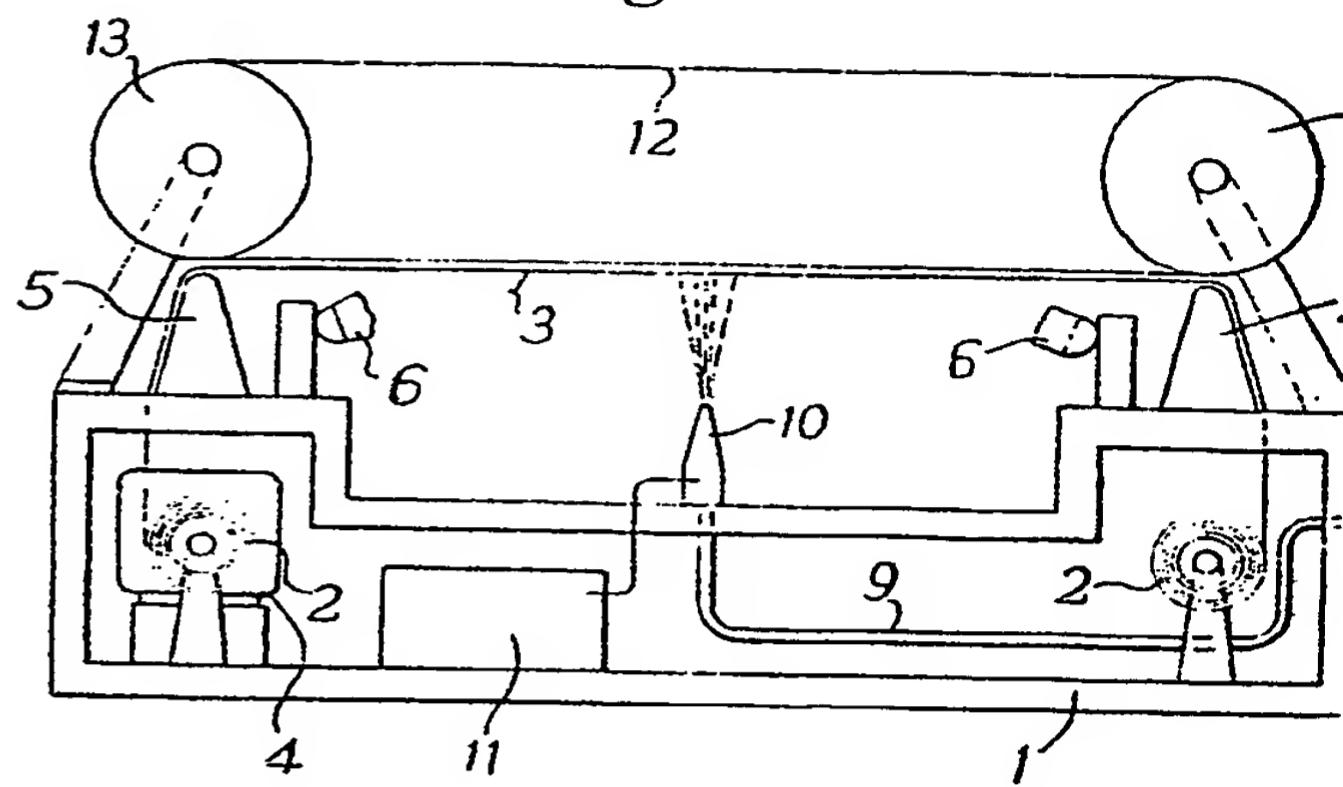
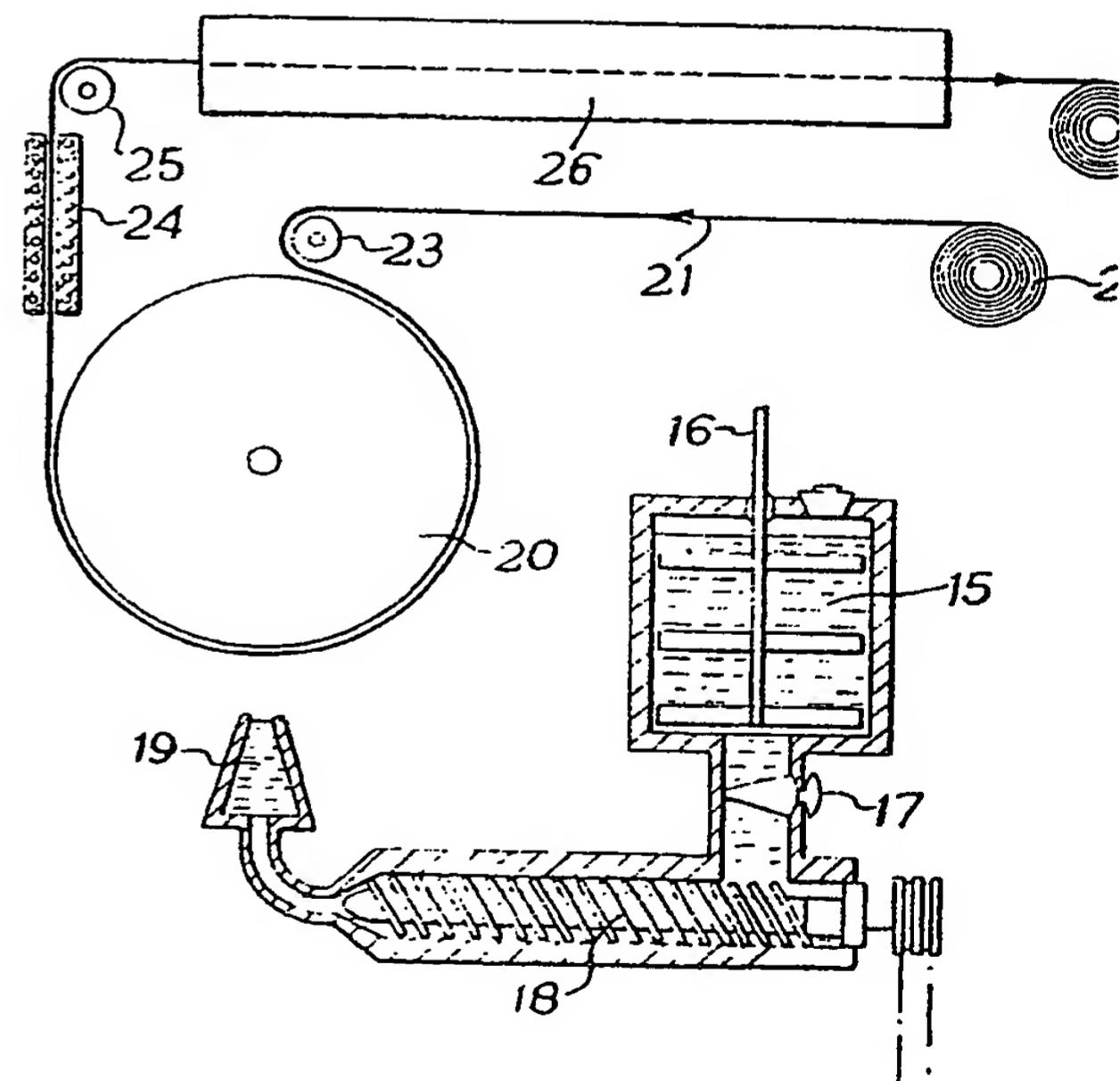


Fig. 2.



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COMPLETE SPECIFICATION

2 SHEETS

*This drawing is a reproduction of  
the Original on a reduced scale  
Sheets 1 & 2*

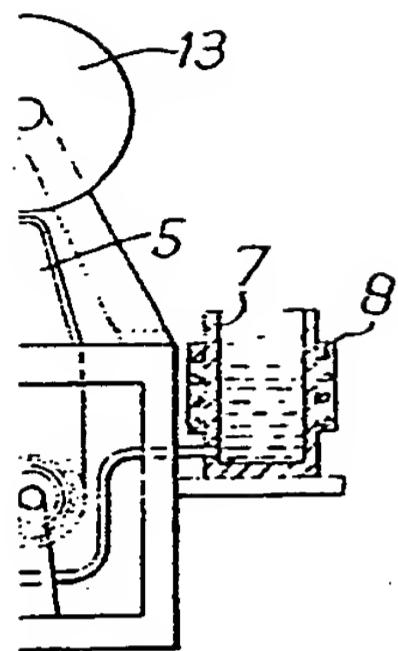


Fig. 3.

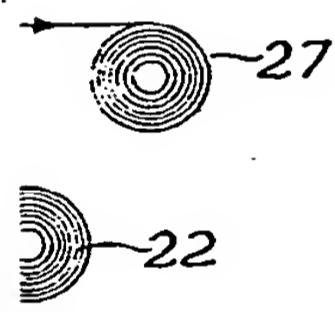
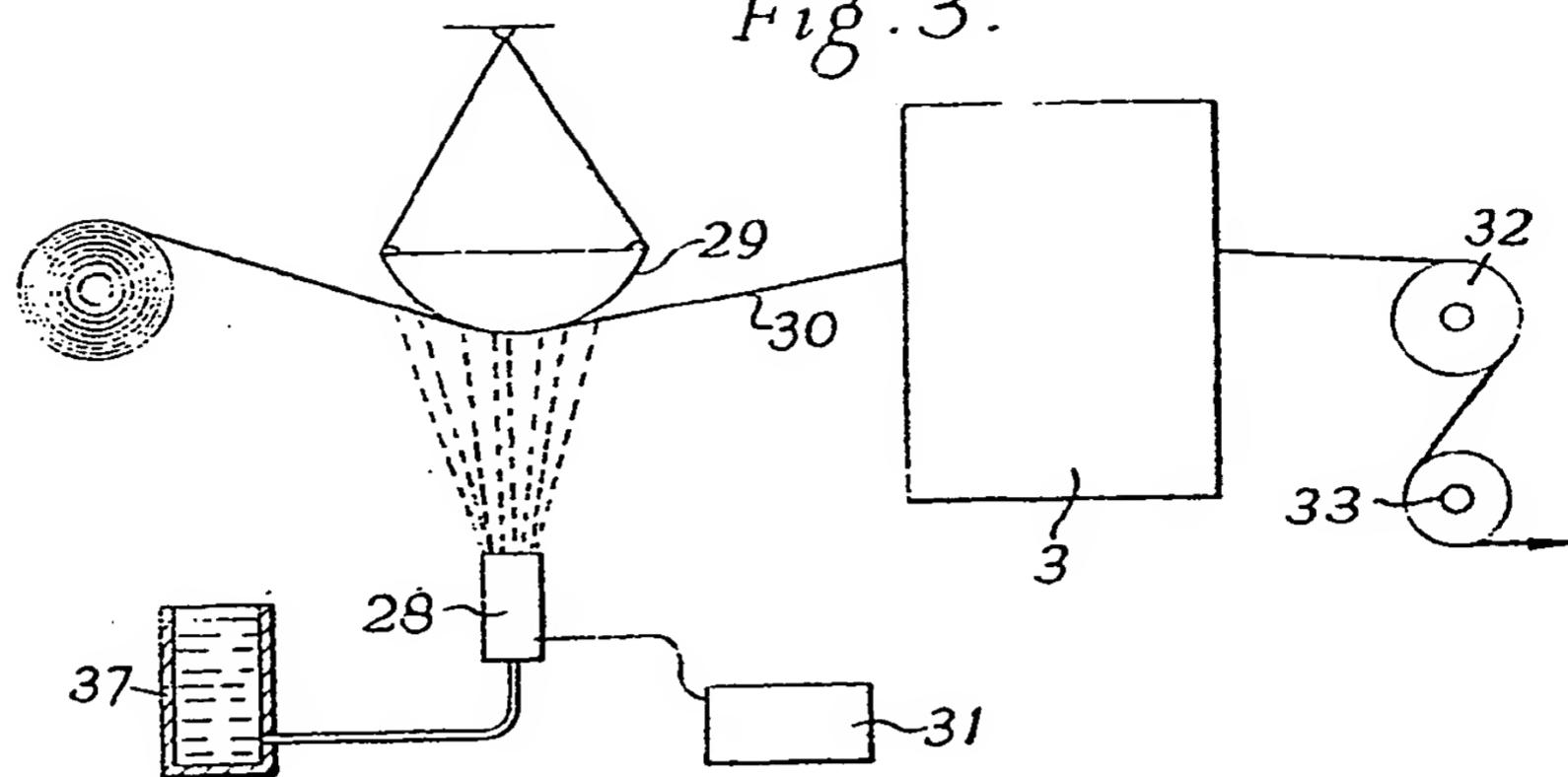


Fig. 5.

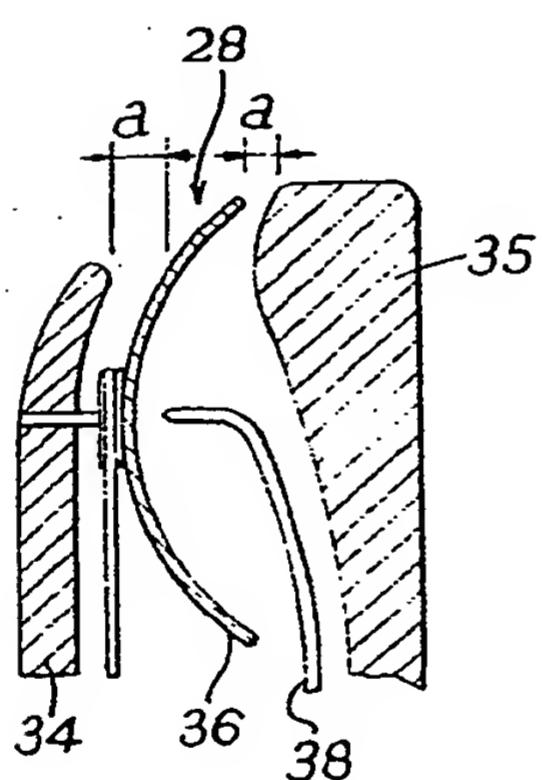
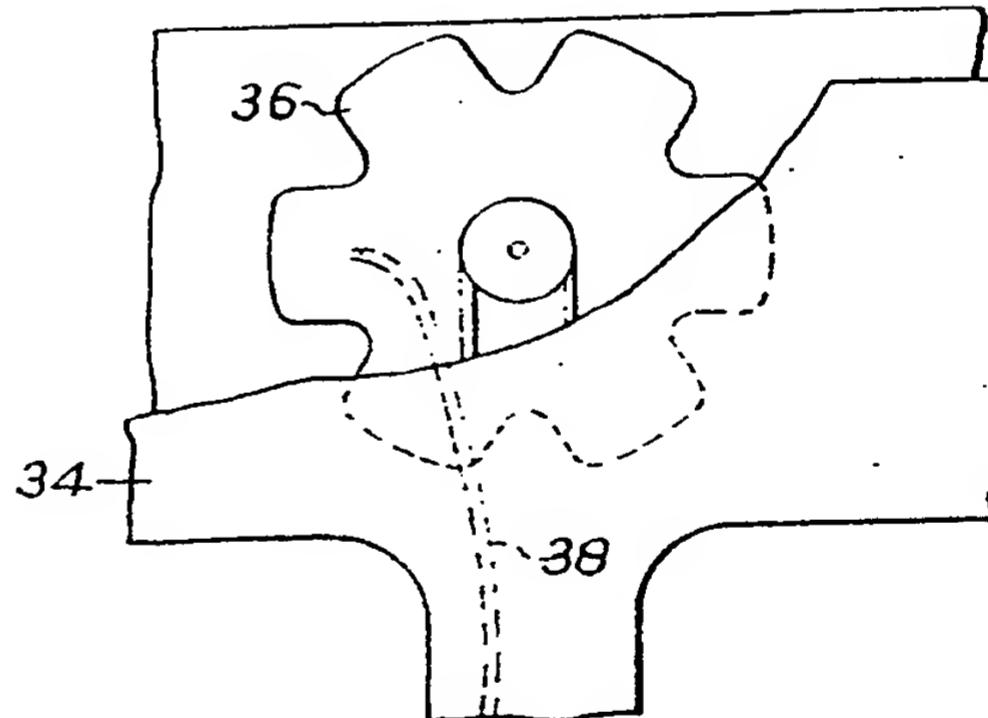


Fig. 4.



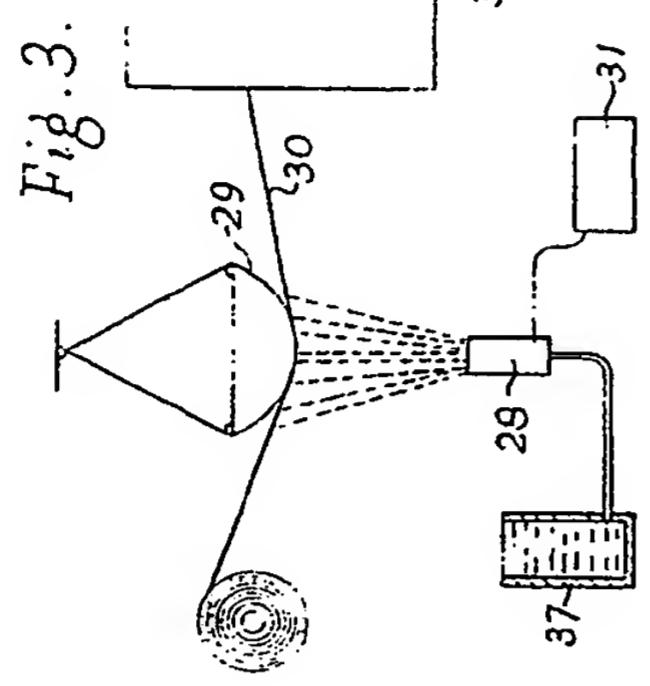
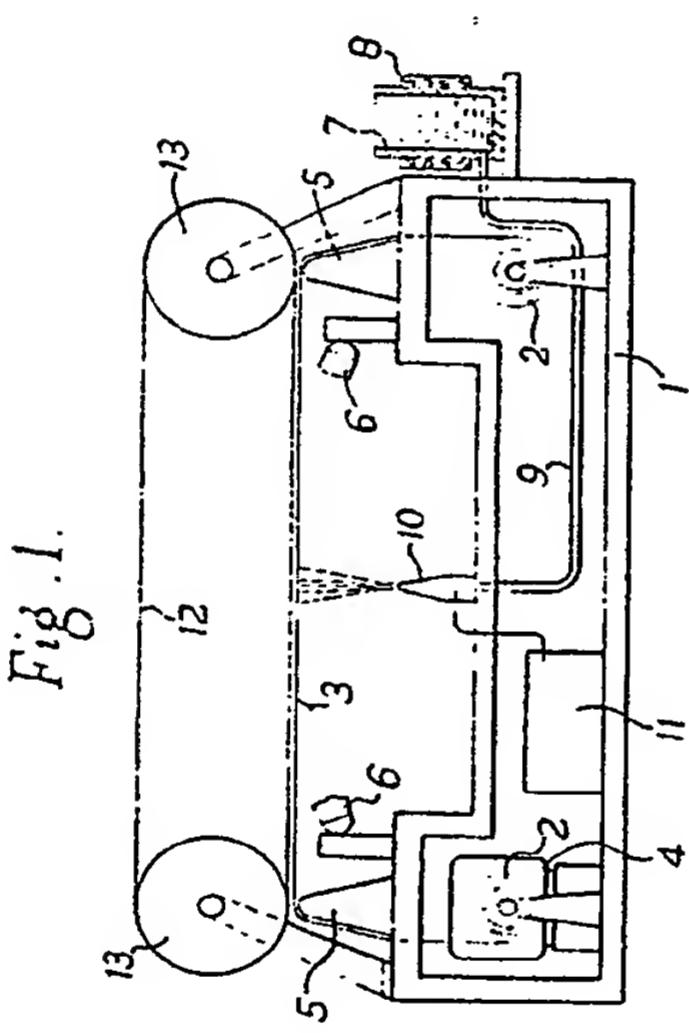
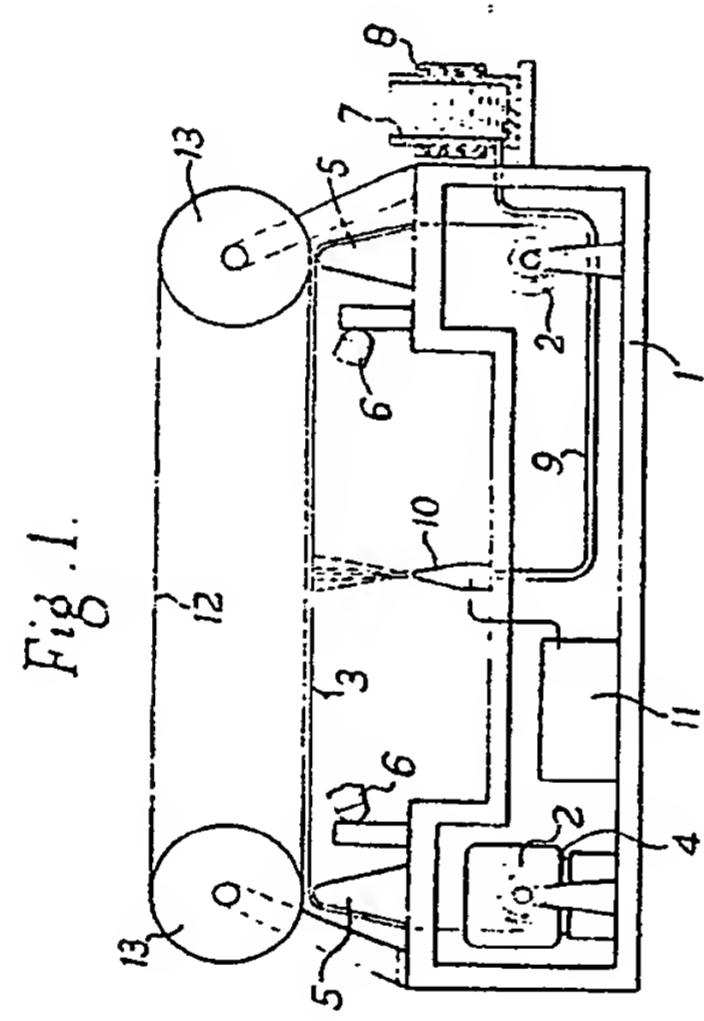


Fig. 5.

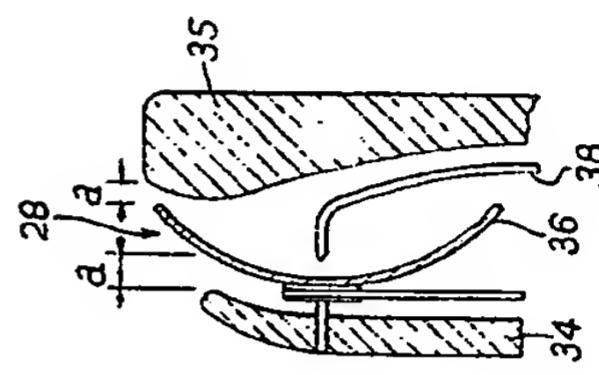


Fig. 4.

